Lustre Global MPTIO Results

GUPFS Project

Overview

This report documents the timing results of the performance tests done on the Lustre File-system. The primary focus of the performance test was to measure the streaming bandwidth in MB/second

The tests included single-stream and multi-stream tests with different file sizes and versions. The evaluation period was on April 30, 2004 and June 16, 2004.

Test Configuration

- We used NERSC MPTIO benchmark to test read and write small (in-cache) and large (out-of-cache) files. All the tests were performed using versions of the Lustre file-system.
- All tests were run on a quiet system. There were no other activities, neither on the clients nor on the storage controller when the tests were running.

The MPTIO Benchmark

- In MPTIO, a single MPI process is spawned on each node.
- Each node creates M pthreads to perform the actual IO.
- When all threads are ready, the MPI processes perform a barrier sync across the nodes so that all the processes start at about the same time.
  - There is certainly no guarantee this will happen, but generally does when the nodes are not over-subscribed as is the case in our tests.
- The MPI process then waits for all the local threads to complete their IO and synchronizes with another barrier.

Timing in the MPTIO Benchmark

- Each thread records the total amount of elapsed (wall clock) time it took to read/write its entire data region.
- Additionally, each MPI process records the elapsed time from when it started the threads working and when they all completed.
- Finally, the MPI RANK=0 process records the elapsed time between the starting barrier and the ending barrier, signaling that all threads on all nodes have completed.
- The per-thread timings are sent to the MPI RANK=0 process.
- The IO rate is then computed as the total amount of data read/written by all threads divided by the maximum total elapsed time as measured between the MPI barriers by process 0.

Linux Configuration

The four test clients and 4 Lustre OSTs had the following configuration:

- Dual 2.2 GHz Xeon P4 processors, SuperMicro motherboard
- 2 GB 133 MHz ECC memory
- The default Linux kernel and qlogic driver included in the standard Lustre release rpms.
  - Note: slightly increased performance can be achieved by using a later qlogic driver.

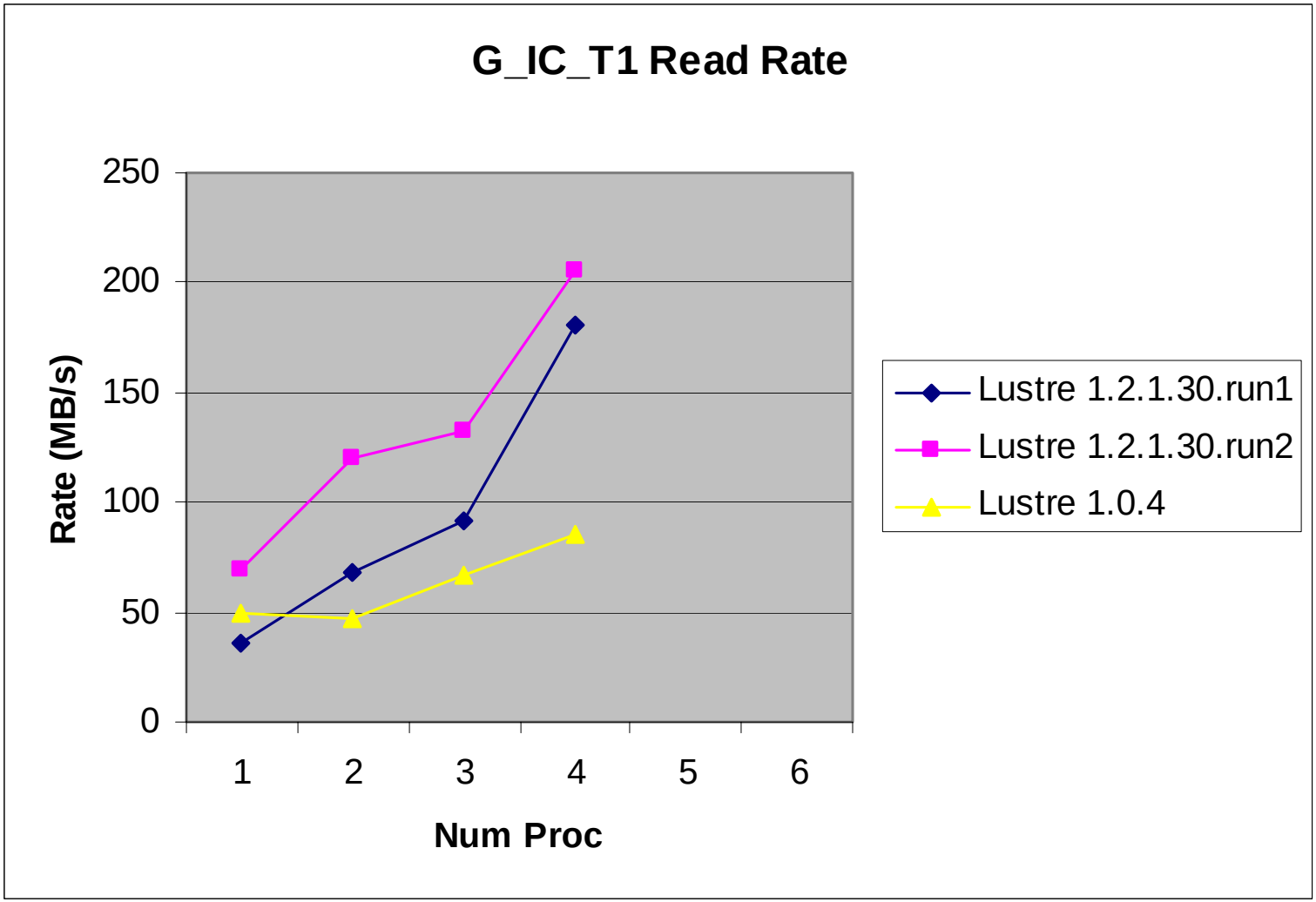
Storage Configuration

- The Lustre 1.0.4 tests utilized an EMC storage controller.
- The Lustre 1.2.1 tests utilized a DDN 8500 storage controller.

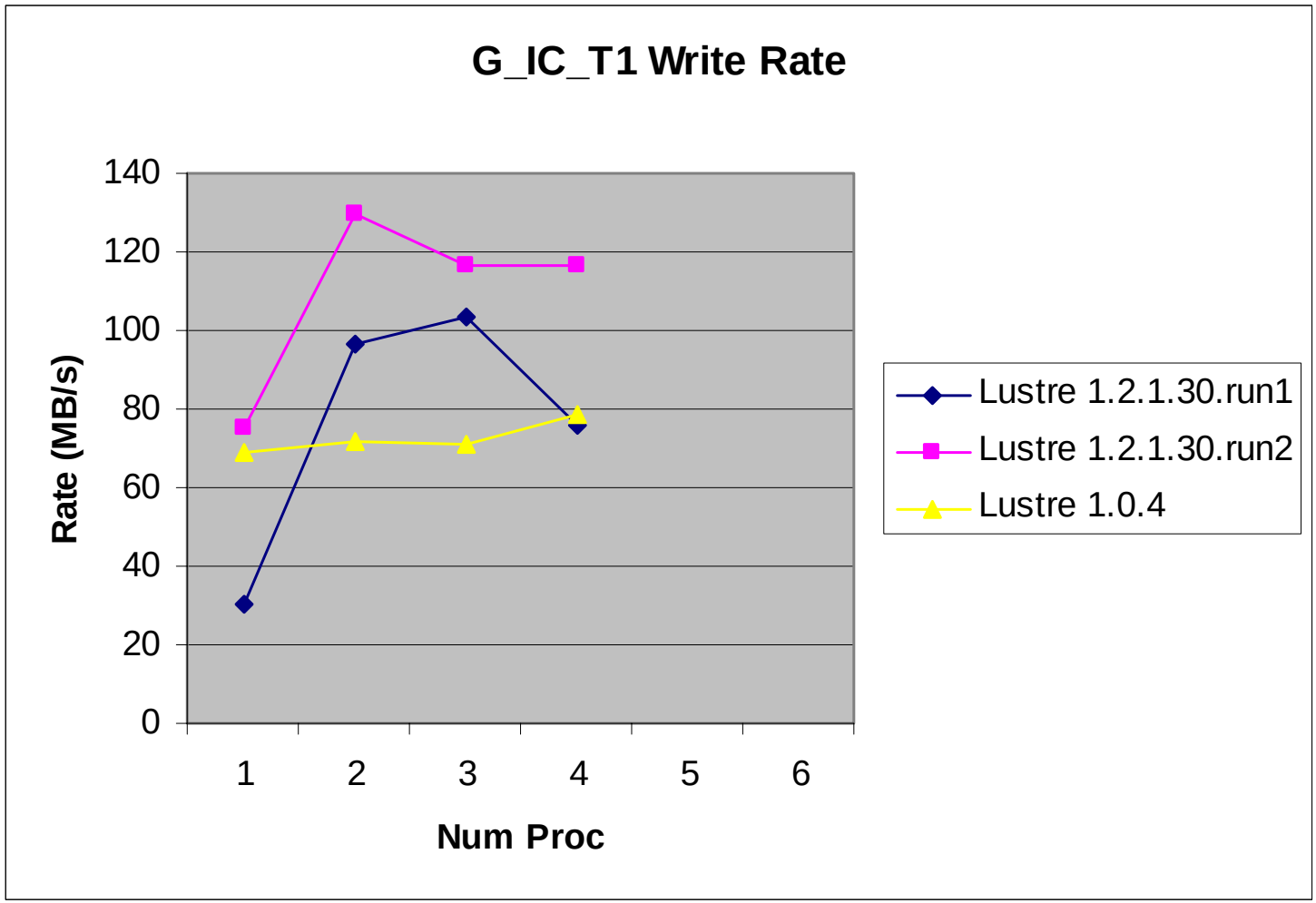
File-system Configuration

- All files were striped across all the OSTs
- Default settings were utilized except:
  - The Lustre 1.0.4 tests utilized default settings.
  - The Lustre 1.2.1 tests utilized a 2MB stripe size.
- The change in stripe size was recommended by the Phil Schwan of Lustre.org to increase read performance in the 1.2.X version of Lustre.
  - This change was caused by network optimizations put into the 1.2.X tree.

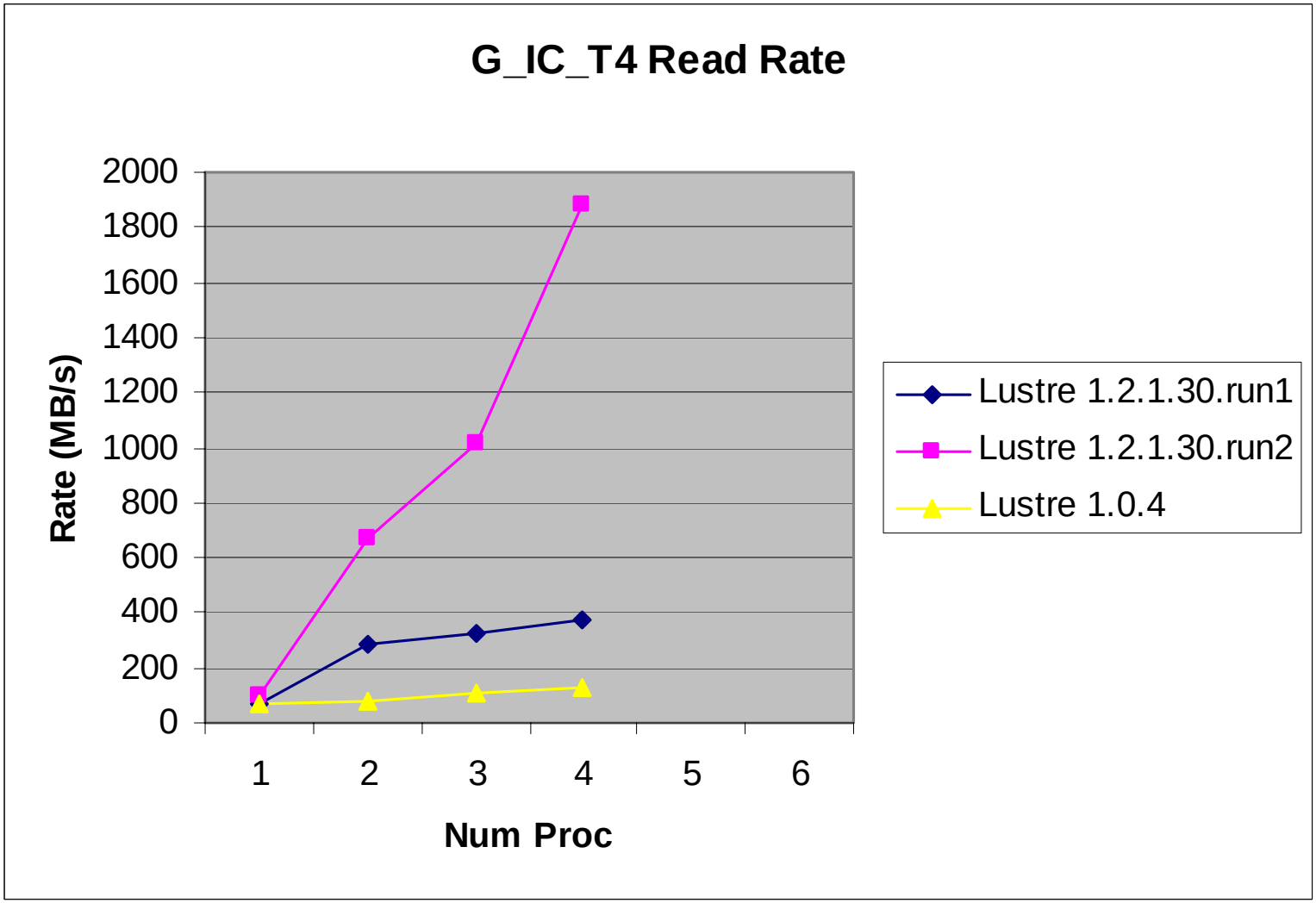
Global File Shared across Threads, In-cache, Single Thread per Node



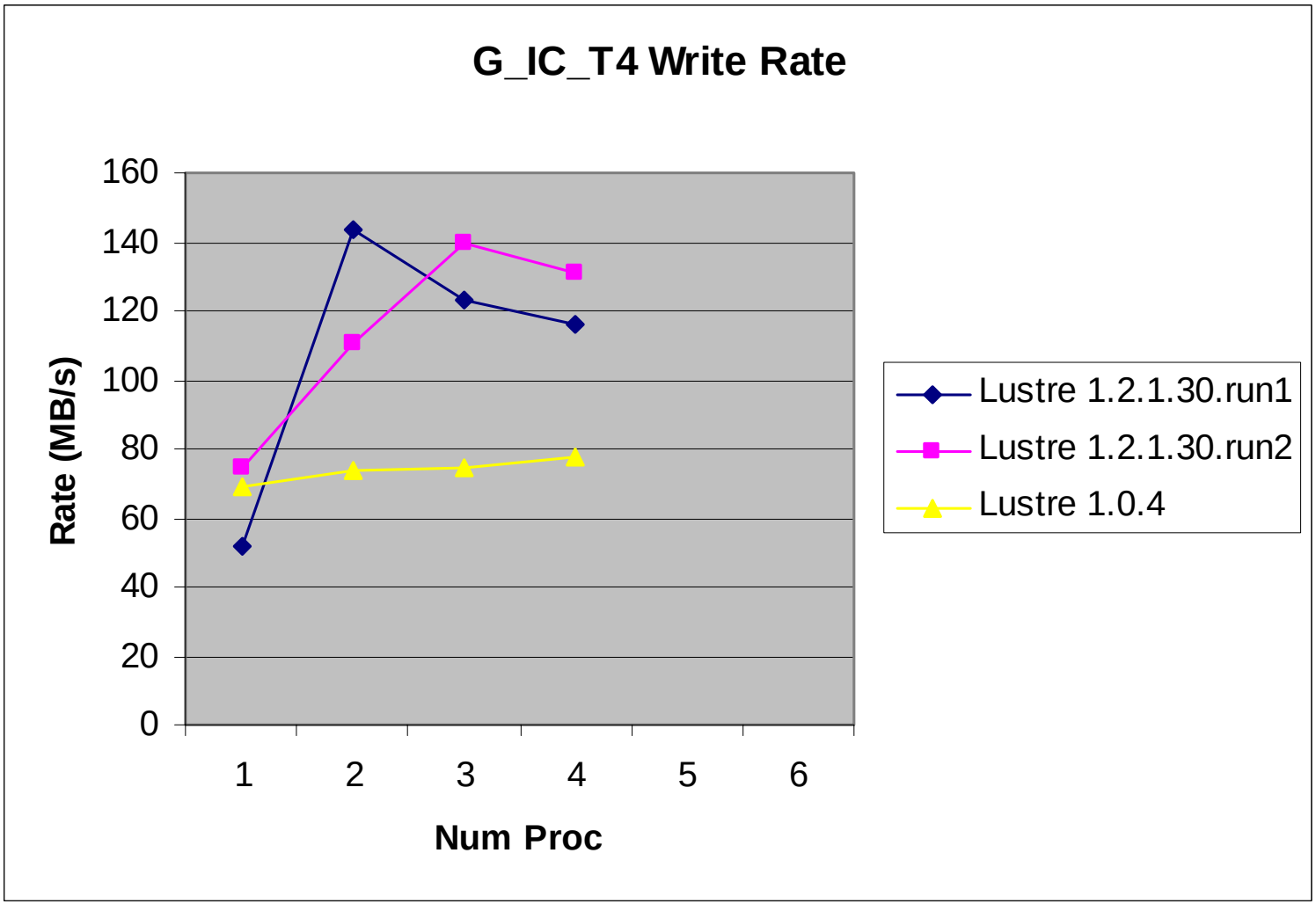
Global File Shared across Threads, In-cache, Single Thread per Node



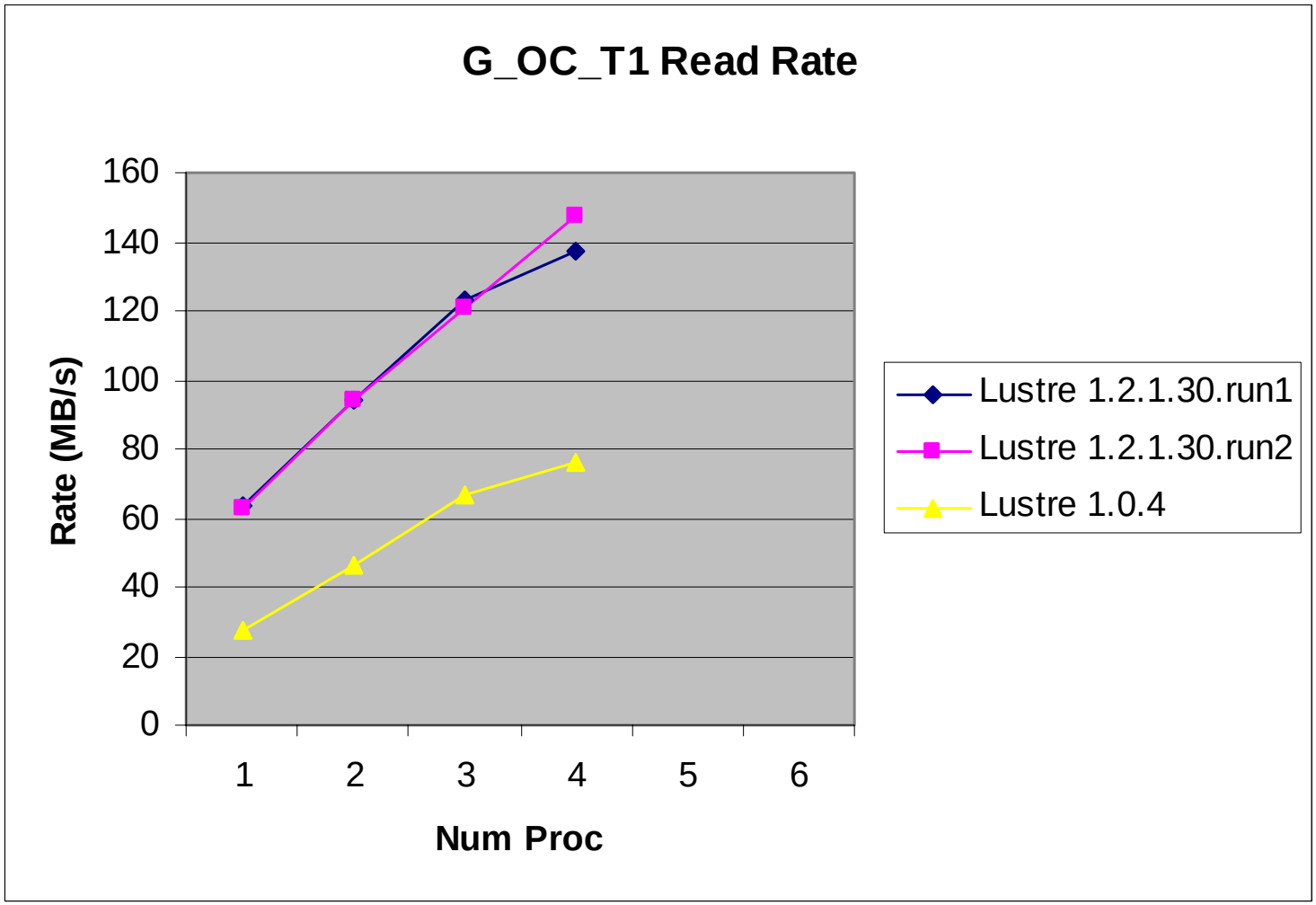
Global File Shared across Threads, In-cache, Four Threads per Node



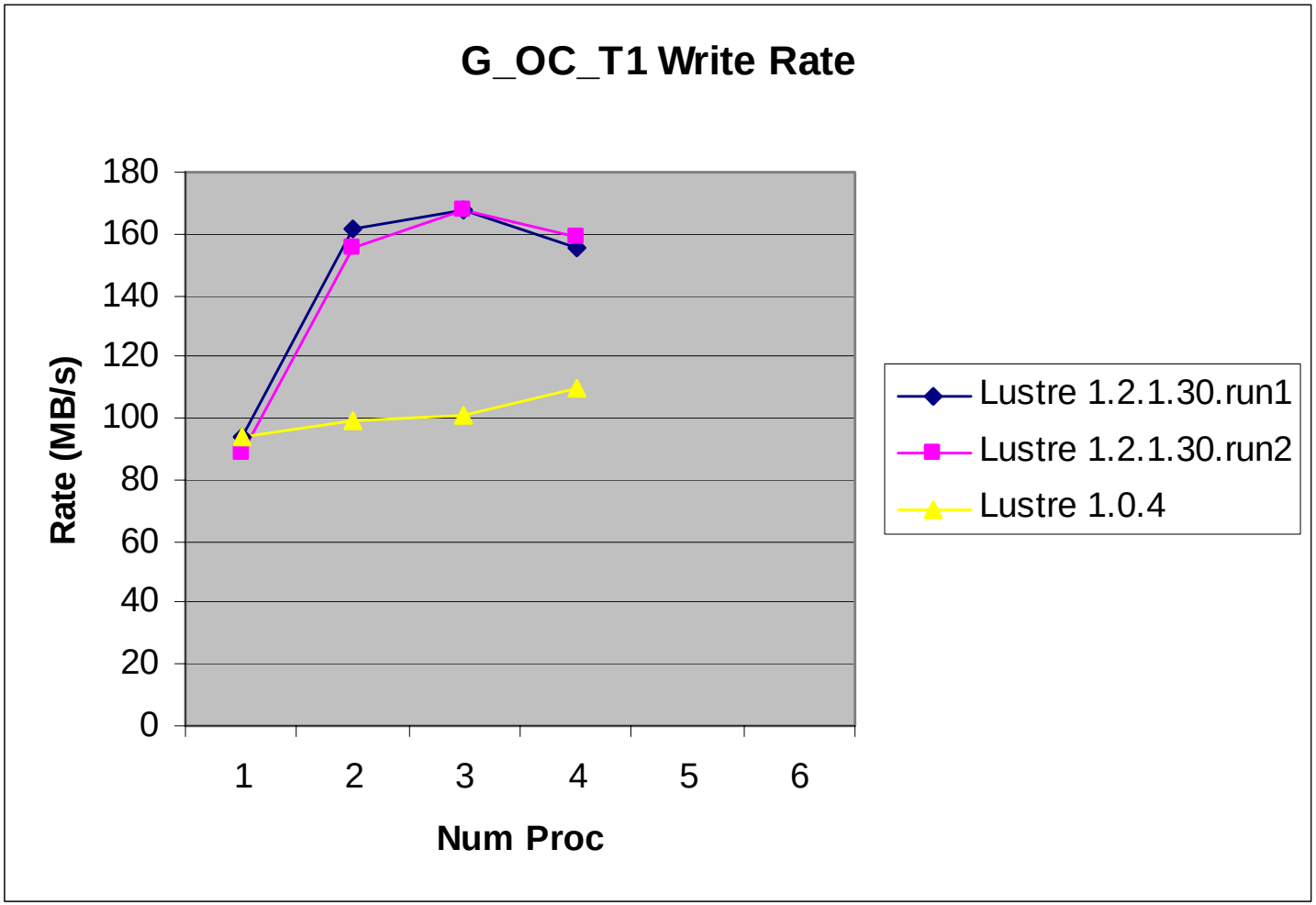
Global File Shared across Threads, In-cache, Four Threads per Node



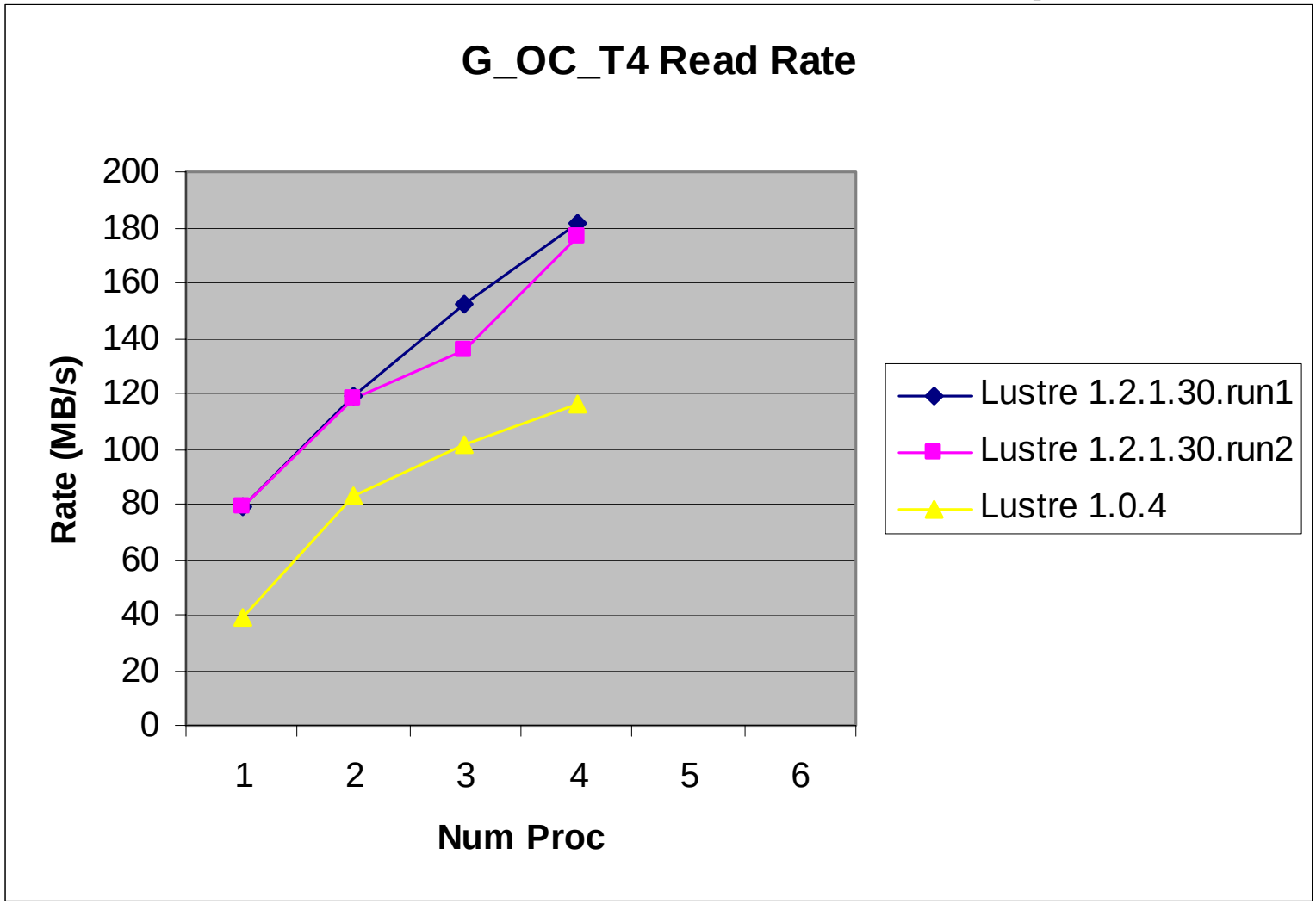
Global File Shared across Threads, Out-of-Cache, Single Thread per Node



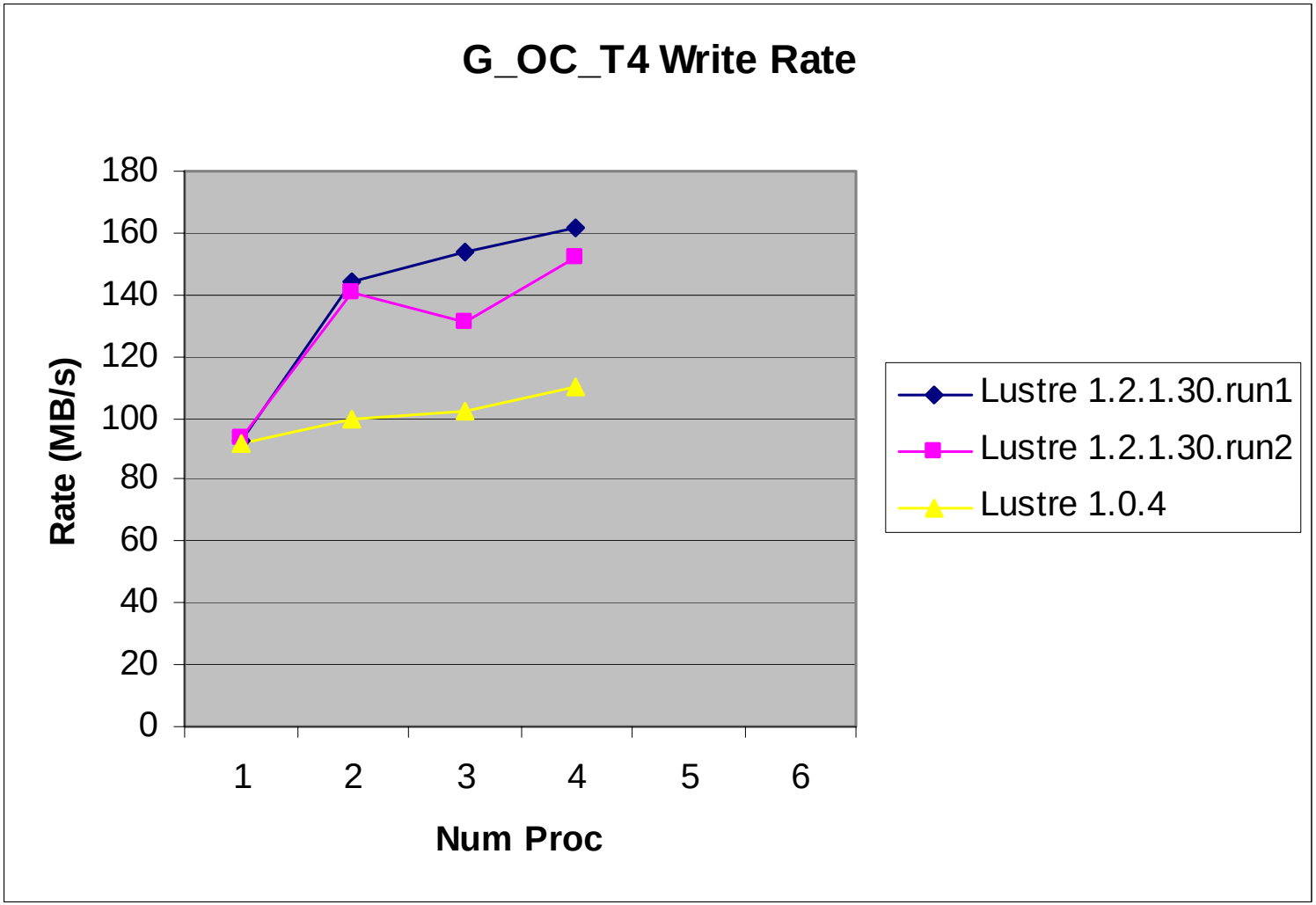
Global File Shared across Threads, Out-of-Cache, Single Thread per Node



Global File Shared across Threads, Out-of-Cache, Four Threads per Node



Separate File per Thread, Out-of-Cache, Four Threads per Node



Conclusion

- Results in progress